FOREST PRODUCTS
Project Fact Sheet

COUPLED PHYSICAL/CHEMICAL PRETREATMENT AND BIOFILTRATION TECHNOLOGIES TO REDUCE AIR EMISSIONS FROM FOREST PRODUCTS INDUSTRIES

BENEFITS

- Coupled pretreatment/biofiltration system
- Limit fluctuations to diminish the pollutant degradation rates or kill the microbes in the biofilter
- Treats higher concentrations of VOCs (2,000-2,500 ppmv) than in existing biofilter units (less than 500 ppmv)
- Smaller-sized biofiltration units, with significant savings in equipment and maintenance costs, and in space requirements
- Extend life of biofiltration media resulting is significant operational cost savings

APPLICATIONS

Simulation, laboratory, and pilot studies will be conducted on the effectiveness of the coupled system in removing VOCs/HAPs from a simulated forest products industry air stream. The results of the pilot studies will be documented and published, and recommendations will be developed for scale-up and testing of the technology in the forest products industry.

Improved Biofiltration System Will Control Emissions of VOCs and HAPs from Manufacturing Processes

Biofiltration systems are usually a good, and emerging, option for controlling VOC emissions from industrial processes. However, the manufacturing of forest products typically involves large fluctuations in the influent air volume and pollutants related to these processes. Because these fluctuations reduce the biofiltration systems' ability to degrade the pollutants in the air stream, often existing biofiltration technology is not capable of efficiently handling the emissions. The most serious problem is periodic "spikes" of very high concentrations of VOCs and HAPs, which can be toxic to the microbes within the biofilter. This research will develop a biofiltration system which can be used by the forest products industry to safely and reliably attain minimal emissions of VOCs at a reasonable operating cost.

Researchers at Michigan Tech University's Institute of Wood Research are using both laboratory and industrial on-site research to better understand biofiltration processes and optimize their performance in the "real world". Initial laboratory studies helped develop advanced laboratory systems, and a pilot-scale system. The pilot-scale system includes an adsorption/desorption unit, on-line GC-FID analysis, and a modular biofiltration design. On-site work with operating industrial biofilters has been used to augment both laboratory and pilot-scale results. In addition, on-site industrial work has served as a conduit for technology transfer of information gained during this project to interested parties in the Forest Products Industry.

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PROJECT DESCRIPTION

Goal: Develop an efficient, cost-effective, and easily implemented method for controlling emissions of volatile organic compounds (VOCs), including hazardous air pollutants (HAPs), from forest products industries.

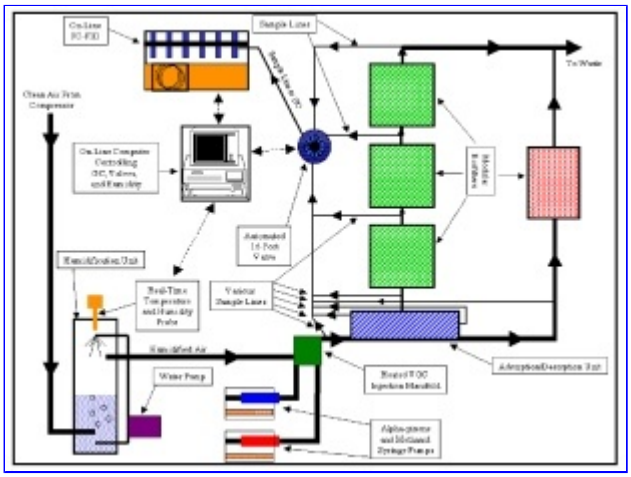
Researchers will couple a physical/chemical pretreatment unit with a second-generation biofilter for the removal of VOCs/HAPs. The pretreatment unit will first concentrate the normally dilute concentrations of VOCs in the air stream by passing the air stream through a solid adsorbent media. Two model VOC compounds will be used (alpha-pinene and methanol) and studies will be conducted to characterize the effect of moisture, temperature, residence time, effects of the microorganisms on the solid support, and concentration on the retention of the VOCs in the adsorbent media.

The process of desorption, in which VOCs leave the adsorbent and flow to the biofilter in a regulated, consistent concentration, will then be regulated by adjustments to the flow rates, the air temperatures, and the moisture content within the solid, VOC-saturated adsorbent. An adsorption-desorption isotherm and longevity estimate will be developed for each adsorbent media.

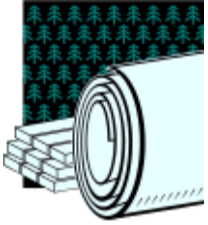
Different microorganisms will be tested in a second-generation biofilter that is capable of degrading relatively high concentrations of VOCs. The best- performing microorganisms will be used in the biofilter in the final-year pilot studies. Pilot testing will be conducted on the effectiveness of the coupled system in removing emissions generated at an operation forest products industry partner site. Influent and effluent air samples will be analyzed for VOCs and HAPs. The results will be published and information provided to the forest products industry.

PROGRESS & MILESTONES

- In Phase I of this project, investigators will develop and test an end-of-pipe air treatment system.
- Microorganisms with the best ability to degrade VOCs without producing toxic by-products in a second-generation biofilter will be used for bench-scale biofiltration experiments.
- In Phase II, in the third year of the project, the bench-scale unit developed in Phase I will be tested on the VOCs and HAPs emitted from an operating forest products site.
- At the conclusion of the pilot tests, recommendations will be developed for larger-scale testing by the forest products industry.



Schematic of the 2 nd Year Integrated Biofiltration System. The system includes 1) humidification system, 2) modular biofiltration design, 3) adsorption and desorption unit, 4) computer controled valves and probes, and 5) on-line GC-FID analysis at virtually every point in the system.



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